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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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"METHOXYCHLOR -- The story of the methoxy analog of DDT...a thorough study of the material through the eyes of a scientist." This was the introduction to the following story, which appeared in the July, 1951 issue of AGRICULTURAL CHEMICALS, published at Baltimore, Md. Its editor has given permission to print the condensation which appears below.

THE STORY OF METHOXYCHLOR

By C. J. KRISTER
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If it were possible to produce an insecticide providing quick kill of any and all insect pests and at the same time being harmless or even beneficial to the health of warm-blooded animals, people in general and agriculture in particular, would regard it as a real achievement. This ideal insecticide would have a residual span much greater than that of any material now known, and in addition would be fool-proof so far as application is concerned. And of course, such a product would be priced economically.

The agricultural chemical industry cannot offer such a fabulous material today, nor any time in the foreseeable future; it can only aim in that direction in the development of new insecticides. This paper describes methoxychlor, a relatively new material which has found a number of uses within the past three years.

Biologists of the Du Pont Pest Control Laboratory first evaluated methoxychlor early in 1942, when it was submitted by E. W. Bousquet([6]). It showed promising biological properties, low toxicity to warm-blooded animals, and safety to sensitive plants.

What Methoxychlor Is: Chemical and Physical Aspects

Methoxychlor is the approved([3]) common name for 2,2-bis(p-methoxyphenyl) 1,1,1-trichloroethane, earlier called methoxy DDT, DMDT, methoxy analog of DDT, and dianisyl trichloroethane. Technical grade methoxychlor contains about 88% of the p,p'-isomer and 12% of closely related compounds. It can be formulated as dilute dusts, wettable powders, liquid oil concentrates, oil emulsifiable concentrates and aerosols. It is slightly soluble in hydroxylic organic solvents, more soluble in paraffinic solvents and vegetable oils, and very soluble in aromatic. chlorinated and ketonic materials. It is insoluble in water, acids and alkalies.

Stable Toward Alkaline Matter

While methoxychlor can be dehydrochlorinated under alkaline conditions to form the unsaturated ethylene derivative, which is an insecticidally inert

molecule, Cristol([8]) found it the most stable of eight DDT-type compounds. As pointed out by Prill et al([16]), greater stability toward alkaline matter is a very desirable property for many insecticidal uses.

Solid methoxychlor is relatively stable to strong irradiation with ultra-violet light. Field results indicate that methoxychlor has a residual effectiveness from two-thirds to as long as that of DDT, depending on the insect to be controlled and other conditions.

Low Toxicity Among Organics

According to Lehman ([14]), "---toxicological problems associated with their (insecticides) use must be considered from several aspects. These may be listed as studies of the acute and chronic effects, dermal toxicity, the biochemical aspects related to absorption, distribution, and excretion, and pathological studies."

Lehman([12]) has compiled toxicity data which indicate that methoxychlor is less than 1/24 as toxic to warm-blooded animals as DDT from the acute oral standpoint, based on feeding tests with white rats.

In further discussion, Lehman([13]) said, "Symptoms from a single acute dose of methoxychlor may not appear, since it is rather doubtful whether an individual would swallow enough to cause poisoning. ---The fatal dose for man is estimated to be in the neighborhood of 450 grams (1 lb.) if ingested at one time."

Chronic Toxicity

The Haskell Laboratory of Industrial Toxicology of the Du Pont Company studied comparative toxicity of DDT and methoxychlor in 1944 and 1946([23]). It was observed that animals fed DDT or anointed with DDT showed a considerable amount of DDT storage in body fat, whereas animals treated similarly with methoxychlor showed little or no storage.

Welch([20]) conducted tests on sheep. Capsules containing 4½ grams of methoxychlor or DDT were administered every morning. The dosage represents the amount of insecticide on one day's feed of forage yielding one ton per acre, sprayed at a rate of five lbs. per acre. Treatment for 60 days with methoxychlor produced no change in weight or appearance. Severe symptoms of poisoning occurred when DDT was fed.

Lehman([12]) has reported that multiple applications of 600 milligrams per kilogram of methoxychlor in solution to the skin of rabbits is hazardous, but with DDT, only 150 milligrams per kilogram is hazardous.

Smith([17]), Zapp([23]) and others have shown that severe tremors, nerve injury and neurological disturbances produced by DDT do not occur when animals are exposed to either large or small quantities of methoxychlor.

Woodward et al[21] and Von Oettingen et al[19] agree that the fate of methoxychlor and also the rate of its detoxification are not well understood.

Biological Aspects

Methoxychlor has been tested against various household insects and those attacking humans[1,2,6,11,15]. Effective in a manner comparable to DDT are 5% dusts of methoxychlor for such pests as bedbugs, both German and American roaches and silverfish. It is also effective against insects which attack stored grain and seed, such as cadelles, grain borers, flour and grain beetles, mealworms, and moths, when applied to surfaces as a 2.5% residual spray.

Use on Livestock

Thousands of animals have been sprayed with or dipped in methoxychlor, and no injury to any animals has been reported. The USDA[5] reports that young calves are not harmed by a single application of as high as 8% methoxychlor.

Although several insecticides are known to penetrate the skin and to appear in the milk of animals, methoxychlor presents no such hazard to consumers of milk products. The appearance of insecticides in milk was described by Carter[7]. In tests on herds of dairy cattle sprayed four times during the summer, weekly milk samples from each herd were analyzed. In over 90% of the samples tested, no methoxychlor was found in the milk. In samples that did show methoxychlor, the investigators doubted the insecticide had been absorbed through the skin of the animal. By comparison, DDT appeared in every sample, and at a level (0.6 p.p.m.) six times that of methoxychlor.

Interest in methoxychlor insecticide reached a new high in the spring of 1949, winning approval by the U. S. Department of Agriculture[18] as safe to use on dairy cows and slaughter animals. The material is effective in controlling many insects affecting livestock. It is not effective against hog mange (sarcoptic) or ticks. It will not control deer or horse flies (tabanids), although it appears to repel these insects for several days.

Some of the more important tests on livestock are described below:

Hornflies: The U. S. Department of Agriculture has reported [5], "Methoxychlor gave good control of hornflies on cattle. A 0.5% wettable-powder spray (2 qts. per mature animal) applied to dairy cattle in Texas and to beef cattle in Kansas provided 20 to 24 days protection, as compared with 28 to 30 days for DDT. In Missouri both materials protected animals for about 6 to 7 weeks.---"

Fourteen official cooperative tests[4] on hornfly control were run during the summer of 1948 in Kansas and Missouri at a concentration of 0.5% methoxychlor prepared from 50% wettable powder. The shortest period of protection was 42 days and the longest was 85 days.

Cattle Lice: Complete kill of short-nosed ox louse was obtained on a herd of 72 steers with 0.4% methoxychlor applied by high pressure sprayer. The hair was found to be insecticidal to lice at the end of 20 days, which is longer

than the known incubation period for eggs of this louse. Other experiments showed that biting ox lice can be completely controlled in one treatment of 0.25% methoxychlor, and long-nosed ox lice with one application of 0.5% methoxychlor.

Stable Flies: In summary of numerous Du Pont tests in barns on stable flies: "Methoxychlor is very good as any residual spray for stable flies on surfaces on which flies remain for a long time. Methoxychlor will do as much to control stable flies as any other residual insecticide currently known."

Cuff([9]) reports that 1% concentration of methoxychlor, when properly applied to dairy cattle, helps reduce the number of stable flies for about one week.

The USDA([8]) reports, "Methoxychlor has shown some promise for the control of the stable fly. In cage tests, a wettable powder spray containing 0.5% methoxychlor applied to cattle prevented feeding of stable flies for several days and killed most of the flies that took blood during the first week after treatment. DDT did not prevent flies from feeding, but killed flies that took blood."

Residual Activity

When used as a spray on cattle at a concentration of 0.5%, methoxychlor will be effective normally for at least three weeks. If the animals are isolated from other animals, they may not have to be re-sprayed for 60 days or longer, depending on when flies infest the premises again. Protection for 2 to 3 months can be obtained by spraying barns and premises with 2 - 2½% methoxychlor.

Use on Crops

Methoxychlor is notably safe on many highly sensitive plants, including cucumbers, melons, squash, and beans. Tomatoes also are not injured by methoxychlor. It is compatible with most of the commonly used fungicides. Flavor of treated crops is not adversely affected by methoxychlor, according to tests conbucted to date, including those of Younkin([22]) on tomatoes.

Residues

The residual effectiveness of methoxychlor against many crop insects exceeds that of rotenone and approaches that of DDT. Normal use of methoxychlor as sprays or dusts will result in harvest-time residues of less than 10 p.p.m. on the following crops (fresh): sour cherries, green beans, apples, cabbage, pears, tomatoes, corn, apricots and alfalfa. Lehman([14]) has indicated that this tolerance would probably not be unreasonable. The effect of processing and canning has also been studied, and residues to date have not exceeded 0.2 p.p.m. of methoxychlor in canned green beans, tomatoes, corn, lima beans, potatoes and carrots.

Extensive laboratory and field evaluation during the past four years has shown that methoxychlor controls a number of important insects which attack crops.

Vegetable crops, such as snap and lima beans, squash, cucumbers, melons and tomatoes head the list of those on which methoxychlor is useful. Its use on fruit crops, such as peaches, early apples, cherries, bramble fruits and grapes, holds considerable promise. Methoxychlor is also effective against a number of insect pests of forage crops, where residue hazards might be involved with more toxic insecticides.

(Editor's Note: Since this article originally appeared, several investigators in different parts of the country have reported new crop insect control applications -- for the cherry fruit fly and fruit worm; plum curculio on peaches, apples, and other fruit crops; and spittlebug and alfalfa caterpillar on forage crops).

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UNUSUAL CHRISTMAS DECORATIONS SUGGESTED BY PETER HUNT DESIGNS

Offering fascinating adventures with the paint brush, Christmas decorations originated by Peter Hunt are inspirations to the novice in folk art. For gay expressions of the Yuletide spirit, the Provincetown artist suggests hand-painted designs that spread a welcome across the front door, trim the Christmas tree, adorn party tables, and grace living room walls.

His peasant designs and "Transformagic" suggestions work wonders with such articles as tin kitchen utensils. Painted jelly molds, hung on a barrel hoop, make engaging door decorations, and cookie cutters turn into tree ornaments. Pie plates, attached to each side of a tree box, are transformed with angel figures.

"Sparkling paint and a brief session with hammer and saw will convert the most unlikely materials into holiday trimmings and gifts," Peter Hunt advises. "Pieces of plywood, old boards, blocks of wood, and discarded furniture are a challenge to your imagination. In decorating them, don't aim for perfection of line. The charm of folk art lies in its simplicity and spontaneity."

Plywood Readily Adaptable for Decorations

This way of painting is achieved by following the basic-stroke technique described in the "Transformagic" booklet, available through Du Pont paint dealers, or by writing to the Finishes Division, Du Pont Company, Wilmington 98, Delaware. The charge for it is twenty-five cents. Madonna figures, angels, stars, evergreen wreaths, and other symbols of Christmas can be accomplished with a tear drop stroke in step-by-step applications, straight or curved, long or short.

A joyful front door greeting is a plywood panel painted red and decorated with four white-robed flying angels, holding a swirling turquoise ribbon. Peter Hunt uses blue for the wings, yellow for stars, and brush--writes "Welcome and Merry Christmas" in yellow. The panel can be fastened to the door with brads, for convenient removal when the holiday season ends.

Glowing candles will look more Christmasy if you put them in holders designed to look like toy churches and houses. Using chunks of wood, you can apply the architectural features with the basic-stroke method. The candle, placed in a drilled hole, forms the spire or chimney of the design.

These interior decorations make such delightful presents that you will be inspired toward more ambitious adventures in transforming old and discarded things into gifts. One of the most enchanting Peter Hunt gift designs is a doll house evolved from an outmoded dresser drawer. The only carpentry work required is the addition of a gable roof and partitions for three rooms. Windows and doors, and the welcoming figures of a man and woman at the front are are all created with bright paint in variegated colors.

The AGRICULTURAL NEWS LETTER again presents some information on the status of the peasant in Russia. Our May-June, 1949, issue published a condensation of a story from the New York Times Magazine called "Life On a Soviet Collective Farm." We received so many requests for additional copies that we had to reprint the story. Since American farmers have always been interested in the less fortunate farmers of other countries, we have obtained permission from the editors to print the following condensation of a story by Michael Padev, which appeared in the July 22, 1951, issue of the New York Times Magazine. The author, a free lance writer, spent most of his life in Bulgaria. He contributes to the Economist (London) and The Manchester Guardian.

THE PEASANT HARRIES THE KREMLIN

His craving for a piece of land complicates each new plan for a communized countryside.

Soviet rulers cannot plan their tactics without taking into consideration the attitude of the peasants, who sometimes support their plans "but more often have actively or passively opposed them," Michael Padev, a free lance writer, said in a recent article in the New York Times Magazine.

The majority of the 800,000,000 people under Soviet rule are peasants, Mr. Padev points out, and he adds: "The problem of the peasant is one of the thorniest that has confronted the Kremlin."

Peasant opposition to the recent plans to intensify collectivization by "consolidating peasant villages into agrogoroda, or large farm 'cities,' " has been so great, he said, that the program has been relaxed and communist officials were allowed openly to criticize it. "The incident was an admission

by the Politburo that even twenty years of collectivization have not transformed the peasant into a dependable worker for the Soviet state."

Because of its glittery promises to divide the land, communism in the early stages was attractive to the land-hungry peasantry of Russia 30 years ago and now in China. Later, however, there comes a rude awakening. "After he has served his initial purpose, the peasant, as such must be destroyed -- either physically, as in the case of the kulaks, or by turning him into a proletarian worker through collectivization and iron controls," Mr. Padev adds. He pointed to Communism's "fundamental antagonism toward the peasant" which produces only one answer: "The independent farmer owning his land and selling its crops, is a dangerous anachronism that must be rooted out of Communist society."

Bitterness of Collectivization Struggle

The fact that millions of people starved to death in the struggle to collectivize agriculture in Russia in the 30's has been well-known for years. Mr. Padev adds the interesting note that during the war Stalin admitted to Winston Churchill that the collectivization campaign "was for him a harder struggle than the war against Nazi Germany."

According to cold statistics, 86.5% of the peasants had been herded into collective or state farms by 1934, whereas 97% of them were individual farmers in 1928.

"But," says Mr. Padev, "the victory was far from complete. The peasants stubbornly remained 'capitalistic' minded." Peasant opposition, in fact, was so great that concessions had to be made in 1933, when each peasant was allowed to retain a little garden plot, and in World War II when it was important to assure "peasant loyalty and peasant manpower for the Army."

Basic Reasons For Agrarian Opposition

There are basic reasons why communism -- as an economic as well as a political system -- is not suited to the peasant way of life. Mr. Padev cites some of them as follows:

The state sets such high production quotas that the peasant cannot hope to keep much of what he produces for himself.

He does not have access to stores, as does the city worker, so he can do little with his small income.

When bad weather causes crop failures, the city worker is benefitted because the usual crop quota is collected -- but the peasant gets less than normally.

"As the collective farms have increased in size," Mr. Padev said, "so has the disparity between the rank-and-file peasant laborer and the army of skilled mechanical operators, clerks and administrators required to run these big holdings."

Complete Collectivization May Never Come

Some of the violent aspects of the collectivization struggle which occured in Russia are now being repeated in Asia, Mr. Padev says. When the Communists moved into North Korea in 1945, millions of peasants fled to the South. "In China, which is also in the pre-collectivization stage, official Communist broadcasts say that in one province alone more than 3,000 Communist officials have been 'murdered by peasants.' In a recent speech Chou En-lai, Premier of Communist China, complained that the peasants were 'dispersing their land and property, killing cattle and destroying farm implements, arable land and trees.'"

How does Mr. Padev visualize the final results of the struggle between the communist state and the Russian peasant?

He stresses that psychological factors as well as the time element enter into the picture. Fundamentally, however, the Kremlin realizes that it cannot convert "the farmer into a Communist by persuasion alone. The alternative is to neutralize the peasant's capacity to resist. This would lead to the final step of 'industrializing' him right out of existence. ...The next generation of farm workers, lacking personal ties to the land, might be as amenable to Communist despotism as factory workers."

Mr. Padev feels, however, that the Kremlin is not yet ready to do this. It does not want to risk the internal convulsions such a step would create when it is involved in sustaining a tremendous armaments burden and is also trying to increase its production of consumer goods.

In fact, in Mr. Padev's opinion, it is possible that the communists may never completely subjugate the peasant, and that if there is ever a rising up of the people of Russia or the satellite countries in Eastern Europe, "it seems likely that the peasant populations will be the first to respond to the signal. The communists know this is their great danger. It may restrain them from rash adventures. If not -- if the showdown comes -- the peasant may be a decisive factor in the ruin of the Kremlin dictators."

BHC AND EPN RECOMMENDED FOR PLUM CURCULIO IN COMMERCIAL ORCHARDS

Benzene hexachloride and EPN insecticide are recommended for the control of plum curculio in commercial orchards by Roy W. Rings in the March-April, 1951, issue of OHIO FARM AND HOME RESEARCH, published by the Ohio Agricultural Experiment Station.

The plum curculio attacks not only plums, but apples, cherries, peaches, pears, and other fruits.

For orchards where "curculio has not been a particularly severe pest," Dr. Rings recommended benzene hexachloride. "In areas where curculio has been troublesome, a new chemical known commonly as EPN is recommended. This insecticide, which controls not only plum curculio but also Oriental fruit moth, European red mite, and two-spotted mite, is used at one and one-half pounds of the 25 per cent wettable powder in 100 gallons of water."

EPN stands for ethyl p-nitrophenyl thionobenzenephosphonate, an insecticide which Du Pont introduced in 1950 after three years of extensive tests. Since it is an organic phosphorus compound, Du Pont recommends that protective gloves, clothing, and goggles, as well as a mask or respirator, be used when applying or handling EPN. Dr. Rings suggests that EPN be used only "in commercial orchards and there only if the grower adheres to and enforces all of the necessary safety precautions." For home orchards, he suggests that lead arsenate "is the most readily available and safest material to use for curculio control."

A new manual of technical data on EPN has been prepared by the Grasselli Chemicals Department. It contains use information on EPN, its results with mites and insects, state and county recommendations, as well as data on toxicology and residues. It lists 82 references. Distribution is limited to entomologists, experiment station personnel, and other technically trained persons interested in agriculture. Address your requests to Grasselli Chemicals Department, Agricultural Product Development section, Du pont Company, Wilmington 98, Del.

DU PONT RATES SECOND IN OWNERSHIP GROWTH

Du Pont stood second in growth of number of stockholders among 355 United States corporations in 1950, according to a study by a national magazine.

For the 355 companies, the net increase in the number of owners for the year was 2.2 per cent. Du Pont was second only to American Telephone and Telegraph in broadening ownership, with a gain of 13.7 per cent.

Twenty-two companies in the U. S. are owned by 100,000 or more stockholders. This includes Du Pont, which is also among the many firms in this group having more owners than employees. Du Pont on June 30, 1951 had 133,799 stockholders and 87,024 employees.

Farmers and Industry ---
Partners in Plastics *

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Farm and forest products flowing in mounting volume into America's factories as the new raw materials of industry give proof measurable in tons that the very basis of our national prosperity is the risking of vast sums of money in search for new ideas and new approaches.

In the field of plastics, the research scientist is discovering how to turn more and more of the by-products from woods, fields, flocks and herds into cash crops for the farmer. And by tapping replenishable sources in growing things instead of exhaustable resources like petroleum or coal for the building blocks to make "better things for better living," research helps more people than only the farmer. By expanding our resources, successful research helps strengthen our entire economy. Each new development creates larger sales, expanded employment and a more substantial contribution to national welfare.

Returns earned by venture money that backers have been willing over the years to save and invest in creative tools of industry, provide the incentive vital to the progress of our system, sparking the extension of research into still further fields.

First Plastic Was Based on Cotton

Discovery of the first man-made plastic, nitrocellulose, launched a development that established a profitable partnership for the cotton grower with industry. Research dating back to 1833 in France culminated in 1869 with the granting of the first patent in America to John Wesley Hyatt for making "Celluloid," the pioneer synthetic plastic.

It was based on nitrated cotton. Its successful development as a plastic was the forerunner of investments in scientific investigations that built the vast industries based on cellulose today, among them the rayon business, and other gigantic enterprises that have built new plants and created new jobs for thousands of men and women.

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* Condensation of an article published in the April, 1951, issue of CHEMURGIC DIGEST, published by the National Farm Chemurgic Council, Inc., New York City. Reprinted by permission of the editors.

Millions of pounds of wood cellulose and cotton linters now are consumed each year as raw materials in the manufacture of nearly 100 million pounds of cellulose plastics. The synthetic camphor widely used as a plasticizer in this type of plastic likewise is a chemurgic product, since it is derived from turpentine from Southern pine trees.

Furfural for Nylon Developed

One of the latest achievements of research scientists is development of a process now making farmers into partners as raw materials suppliers for the production of nylon, one of industry's most fabulous creations in the past ten years, and valuable in plastic form as well as for textile fibers. This is the development by Du Pont research of the process for making nylon intermediates from furfural. It has been estimated it will take about 200,000 tons of agricultural by-products like corncobs and oat hulls a year to supply the amount of this intermediate Du Pont alone needs. Much of the key nylon intermediate, adiponitrile, will go into nylon plastics.

Chicken feathers, animal claws and hoofs, and turtle shells can be used to make a keratin plastic resistant to deformation by heat that gives promise for development as a useful synthetic. Zein from corn, casein from milk, and substances yielded by processing of nuts and soybeans, also have been successfully developed for use as basic raw materials for plastics.

Agricultural Origin Often Forgotten

Plastics are so familiar that unless attention is directed to the specific product, the agricultural origin of many articles may escape recognition. "Pyralin" cellulose nitrate plastic, though the first plastic made by Du Pont, is still in wide use.

This pyroxylin plastic, as it is also known, is produced in the form of sheets and rods, which fabricators shape and mould into a variety of consumer articles.

Tough, economical pyroxylin plastics are being made in practically every shade and hue and in beautiful transparent, translucent, mottled, opaque and pearl effects. This beauty and durability is found in fountain pens and mechanical pencils, shaving brush handles, shoe ornaments, coverings for wooden shoe heels, spectacle frames, buttons, bathroom fixtures, and other familiar products.

Research Investment Is High

Investors confident in the integrity of our American system had risked $27,000,000 in the ten years' search that yielded the discovery of nylon and in building the plant to make it before this new product was ready to be put on the public market. Du Pont announced nylon in 1938. But in 1935, three years before the announcement, chemists in the company's Electrochemicals Department at laboratories at Niagara Falls were already at work on the search which in 1947 succeeded in making farmers partners in the new industry.

Du Pont spent the decade of research not only seeking how to make the finished product, but also in a search for ways to make the chemicals from which nylon is produced. When Dr. Wallace H. Carothers first made the polyamide now known as nylon, there were no commercial processes for making the two necessary building blocks, adipic acid and hexamethylene diamene, called nylon intermediates.

The first processes Du Pont developed made use of phenol. Later methods used benzene, from coal; ammonia, from the air and water; and hydrogen, from the air.

Research on Farm Products for Nylon

In the fall of 1935, the Niagara Falls laboratory of Du Pont's Electrochemicals Department began exploring the avenue by which farm crops and wastes were to be channelled twelve years later into nylon.

Furfural, which can be made from oat hulls, corncobs, cottonseed hulls, flax shives, bagasse, peanut shells, rice husks, or recovered as a by-product of the wood fiber industry, was the chemical investigated. Du Pont spent 14 years and about a million dollars in research before shipping the first batch of nylon intermediates made from furfural in 1949, when the new Niagara plant went into operation.

Development of the new source was hailed in 1947 as an outstanding chemurgic achievement. Since the first plant began producing, plans have been made to double the output by building a second plant. When it goes into full operation Du Pont's needs for furfural will require the processing of about 400 million pounds of corncobs, oat hulls and cottonseed hulls a year. Here's a sizable outlet for farm by-products that 20 years ago had little or no cash value.

Thus has research handed farmers a cash stake in plastics, films and fibers.

Agriculture and Industry Cooperate

But the farmer and companies like Du Pont are only parts of the economic organization represented by the plastics business. Agriculture and industry are interdependent with the thousands of little businesses that have sprung into being to take the basic products of farm and forest as the raw materials for their enterprises, and transforming them into the plastics, rayon, cellophane, nylon and countless other consumer products.

Du Pont and other companies buy materials from other sources besides the farmer. There are no less than 30,000 companies supplying Du Pont. A huge percentage of them are small businesses. Du Pont in turn sells to more than 65,000 firms. Ninety per cent of them are classed as small businesses.

The thousands of smaller units could not thrive as they do today if each had to start with corncobs, oat hulls or cellulose as its raw material,

since the economic transformation of such raw materials into useful chemical intermediates frequently calls for resources not available to the smaller industrial concerns.

Farm and Industry Gains

Here, two industries in which the farmer is an important partner demonstrate that the basis of our national economy is the risking of large sums of money in search of new ideas and new approaches. The gains each has made for the farmer, the little businessman and for Du Pont have been achieved only because people have been willing over the years to save money and invest in creative tools of industry.

The inducement to this investment in America has ever been the expectation that the saved dollars will earn their productive return. It is the intelligent self-interest of millions of investors seeking reward for their thrift in the knowledge they cannot benefit from our economy unless their contribution benefits the economy that has made this nation great.

Our future is dependent on keeping this vital economic operation in smooth working order.

CALIFORNIA LIMA BEAN TESTS (continued from page 120)

In this test, when lindane was used alone, the stand of normal plants was 33.3 seedlings per 100 seeds. When lindane was combined with each of the four fungicide treatments, the number of normal plants were respectively 68.5, 56.5, 83.7, and 81.2. This compares with 51.8, 51.2, 59.0, and 62.5 for the fungicides alone.

General Discussion

In their discussion of the trials, the authors of the bulletin stress the importance of protecting lima beans against seed decay through seed treatment. They noted that all the fungicide treatments "significantly improved the emergence of both Fordhook and Ventura lima beans," although they did differ in degree of effectiveness. Lindane gave excellent control of seed corn maggots when they were encountered.

"A significant feature of the present tests," said the authors, "is the adverse effect when Fordhook or Ventura lima bean seeds were treated with an insecticide alone....The redeeming feature of this injurious effect....is that when a fungicide is added to the treatment, the adverse effect of the insecticide disappears for all practical purposes.....From these trials it appears that lindane, 'Aldrin' and 'Dieldrin' insecticides should always be used with an adequate fungicide in order to avoid the adverse effects which can occur under certain conditions."

ADVANTAGES OF FILM BAGS FOR PREPACKAGING CHERRIES SHOWN

A study of methods of shipping cherries on the Pacific Coast has demonstrated the economies of using transparent film bags.

The study was conducted by the Production and Marketing Administration of the United States Department of Agriculture in the 1950 season. It covered 41 carloads of prepackaged cherries shipped by four plants in California, Washington, and Oregon. Costs of using the conventional wooden shipping box and four types of consumer-size containers were investigated. Prepackaging cherries in transparent film bags was the least expensive of the methods studied. These cherries were sold at retail at somewhat lower prices than those in the other types of containers.

The five types of containers studied were: Transparent film bags, window cartons, plastic baskets, overwrapped trays, and the conventional 15-pound wooden box with the cherries faced in rows. Row-packing and facing cherries in the conventional boxes cost about 30 cents more per 15 pounds than packing them in transparent bags. The cost of packing in the other containers was higher than in either the film bags or the conventional box. It was emphasized that these findings are based on a single year's work, and that these relationships may or may not hold true over a longer period.

Equipment Developed For Handling Cherries

In this cost and efficiency study, new or modified pieces of equipment were developed. These included a new sorting and packing table, a new mechanical box dumper for dumping cherries from field boxes onto a sorting table, a new bag holder for filling consumer-size bags of cherries, and a blower device for removing leaves and trash from the cherries before sorting.

The Department of Agriculture said that total cost of prepackaging cherries in transparent film bags, including the cost of packaging materials, shipping containers, labor, and pre-cooling, amounted to 56 cents for the equivalent of a 15-pound, double-row faced box--the conventional wooden box pack. This was 30 cents less than the comparable figure of 86 cents for packing the 15-pound faced box, in which the top two layers of cherries are individually sized and placed in rows by hand. The cost of packaging materials and labor was somewhat higher on the other three types of consumer packages; the total cost amounted to 97 cents for window cartons, $1.36 for plastic baskets, and $1.72 for overwrapped trays for the equivalent of a conventional 15-pound faced box.

Consumers Benefited From Lower Prices

The market price for the cherries prepackaged in the film bags, f.o.b. shipping point, was somewhat lower than for comparable cherries packaged in the 15-pound faced box.

Studies were also undertaken to develop more efficient techniques of packaging cherries in consumer packages by making motion and time studies.

A new table for sorting and packing cherries was developed, which can be used for packaging cherries either in consumer packages or in the standard boxes. An important characteristic of the new table is that it enables the operator to roll the cherries into the container rather than lift them, which greatly reduces hand movement. Culled cherries are discarded at both sides of the table by tossing them against canvas disposal units, rather than on one side only, as was previously done. This not only enables the operator to discard the culls faster, but also permits her to keep her eyes closely on the sorting before her.

Box Dumper and Bag Holder Devised

A new mechanical box dumper also was developed to lessen the rough treatment and bruise damage to the cherries when they were pulled by hand from the box to the packing table by the operators. Important features of the mechanical dumper are that it allows the cherry boxes being dumped to pivot around a top corner of the box, which reduces the distance the cherries must fall into the sorting area. The mechanical dumper enables the box to stop at any tipped position and continued to hold the box in that position. Cherries are dumped onto the table by pulling forward on a large lever.

A bag holder also was developed for use in filling film bags with cherries. A previous method, used by one of the cherry prepackaging plants cooperating in this study required the worker to hold the bag open with one hand and fill in the cherries with the other. Another packer followed the practice of having the worker fill a cylinder with the desired quantity of fruit, which was then dumped into a film bag. Another plant had already developed a method of automatically filling film bags with the desired quantity of fruit. This automatic method of filling bags was found to be very efficient for large-scale operations.

Bag Holder for Smaller Operations

The new bag holder was developed for smaller operations. It is mounted on a scale located between the worker and a moving conveyor belt containing loose cherries. The opening of the bag fits over an expanding type of collar on the bag holder, which then holds the bag firmly in position for filling. The operator rolls the cherries with both hands from the belt into the bag until the desired weight is reached, after which she releases the collar and removes the filled bag of cherries. The bag can then be closed by stapling a saddle header on it, or by various types of heat-sealed closures.

The work described above was done under the direction of Fred H. Westberg, manager of the Washington Fruit Commission. The Production and Marketing Administration of the United States Department of Agriculture points out that consideration would have to be given by packers to present and prospective supplies of transparent film before plans are made to package fresh cherries with this material.

FARMER INVESTIGATIONS SHOW SEED TREATMENT INCREASES FORAGE CROPS

On 72 farm fields in 19 states, portions of pasture and hay land were turned into practical experimental laboratories during the summer of 1951. Data compiled by Du Pont Company plant pathologists as a result of these tests showed more livestock feed per acre may be expected when a chemical treatment is applied to grass and legume seed to protect it against seed-borne and soil-borne disease organisms.

Tests were arranged with farm owners who were seeding a variety of forage crops as a regular farm management practice. In each case, a portion of the field was planted with seed treated with "Arasan" seed disinfectant, an organic sulfur compound. Remainder of the field was planted in exactly the same manner with untreated seed.

While test conditions reflected variations in soil moisture, texture, fertility, and seeding methods on 72 fields in wide-spread sections of the country, averages showed a healthy increase in plant stands in favor of treated seed. Following are average results with principal forage crops:

Crop	No. Tests	Increase
Alfalfa	28	33%
Alfalfa-clover mixture	11	44%
Sweet Clover	7	6%
Miscellaneous legumes	9	22%
Sudan grass	7	51%
Miscellaneous grasses	10	36%

How Tests Were Conducted

In each test, plants were actually counted in measured areas of both treated and untreated seedings. A number of such areas were spotted through each section of the field to avoid selection of locations where fertility or drainage was particularly favorable, or unfavorable. These plant counts from treated and untreated seed were then compared to determine the value of the new treatment.

The "Arasan" coating on the seed actually serves as a chemical "overcoat" to protect the plant embryo from fungous diseases such as seed rot, seedling blight, and damping-off. The chemical is toxic to these disease organisms, yet harmless to the seed itself. "Arasan" does not injure these tiny seeds as would some of the mercury compounds used on grain. Advantages of treating these small seeds have been demonstrated in greenhouse flats and small field plots during the past two years. The cooperative demonstrations with farmers this year provide practical large-scale tests under actual farm conditions.

The average increases cited for various crops are believed to reflect results the grower can expect under ordinary conditions.

DOUBLE PROTECTION OF LIMA BEAN SEED STRESSED AS RESULT CALIFORNIA TESTS

The importance of using fungicides on lima bean seed for a dual purpose is highlighted as a result of field trials conducted in California during the 1951 season.

These tests showed:

1. Significant improvement in stands of lima beans can be obtained by using fungicides to protect the seed against decay and disease;

2. Insecticides used to protect the lima bean seed against wireworms and seed corn maggots have an adverse effect on the emergence of the seed, particularly under conditions of severe seed rot. This disadvantage, however, disappears when a fungicide is added to the insecticide in treating the seed. The fungicide is thus given the new function of overcoming the adverse effects of the insecticide.

3. It is desirable to have an insecticide-fungicide combination treatment for protection against the seed corn maggot. Use of a fungicide-insecticide combination constitutes no special problem, as the two can be applied to the seed simultaneously in the regular slurry treating machine.

California Bulletin Describes Experiments

The experiments were conducted in April, May, and June, 1951, under the auspices of the College of Agriculture of the University of California at Davis. The findings are summarized in a 16-page mimeographed bulletin compiled by F. J. Hills, extension agronomist, W. H. Lange, assistant entomologist, L. D. Leach, plant pathologist -- all three of the University of California at Davis; and J. B. Kendrick, Jr., assistant plant pathologist of the California Citrus Experiment Station at Riverside. It was issued on August 17, 1951.

The authors point out that field trials conducted in California in 1950 "showed that combination fungicide-insecticide seed treatments materially improved the emergence of Standard large lima beans. Since fungicides and insecticides were tested in various combinations and not separately in these earlier trials, it was impossible to assign observed effects to individual components of the combination treatment. There has been a good deal of interest and speculation as to the effect of lindane on the emergence of lima beans." The 1951 tests were therefore amplified to note the effect of using insecticides alone, as well as to observe the best combinations of fungicides-insecticides.

Lindane, the generic name for the gamma isomer of benzene hexachloride, is a concentrated form of BHC with little or no odor and is less toxic to plants. When BHC was introduced commercially as an insecticide after World War II, it was found to be useful for the control of many insects, but was objectionable to many people because it had a musty odor. This objection was overcome with the development of lindane, which is now available from many chemical suppliers.

Tests Included Ventura and Fordhook Lima Beans

To test the Standard lima beans, a single 100-pound sack of the variety Ventura was split up into 10 lots. One lot was left untreated; a second was treated at the rate of 1/3 ounce of wettable lindane per 100 pounds of seed, and the remaining were treated with one of four fungicide treatments, with and without the lindane. The fungicide treatments consisted of "Arasan" SF seed disinfectant, 1-1/3 ozs.; "Spergon," 3 ozs.; "Spergon" SL, 2 ozs.; and "Vancide" 51, 4 ozs. per 100 pounds of seed.

All ten combinations were planted in six different locations, and at each location the treatments were replicated six times. Each replicate consisted of 100 seeds dropped in a row about 50 feet long.

"When these trials were being established," as stated in the bulletin, "grower interest prompted a second series of treatments with Concentrated Fordhook limas. 'Aldrin' and 'Dieldrin' insecticides were added to this series to obtain more information on their effect on seed maggot control." "Aldrin" 50% was used at the rate of one ounce and "Dieldrin" 50% at 1/2 ounce per 100 lbs. of seed, with and without a fungicide. The other treatments were the same as in the first series

Insecticide Alone Causes Low Emergence

The tests showed that there was a significant reduction in the emergence with the use of lindane alone. When a lindane-fungicide combination was used, however, emergence was greater than when no treatment was used, or when lindane was used alone and was in most instances comparable to the fungicide alone.

Taking the data from all six locations in the Ventura series, the authors of the study made a table summarizing the average of emergence of non-treated seed, seed treated with insecticide alone, with fungicide alone, and with a fungicide-lindane combination. Here are the results:

1. When lindane was used alone, the emergence was at its lowest point -- an average of 41 seedlings per 100 seeds planted.

2. Seed which had no treatment of any kind did better than when the insecticide alone was used. The average in this classification was 52 seedlings per 100 seeds.

3. Seeds treated with fungicides alone, in tests involving the use of four different seed treatments, produced respectively 62, 63, 69, 70 seedlings per 100 planted.

4. A combination of lindane and each of the above four fungicide treatments produced respectively 59, 63, 66, 69 seedlings per 100 planted.

Results with Fordhook Lima Beans

The second series of tests showed substantially the same results as did the first. The three insecticides alone caused a decrease in emergence; when a

combination fungicide-insecticide was used, emergence was much improved.

The summary of all the Fordhook trials in three California locations showed that when the insecticides alone were used, the emergence, per 100 seeds planted, was as follows: Lindane 26, "Aldrin" 23, and "Dieldrin" 26. This compares with 47 plants with no treatment at all; 81 with "Arasan" SF seed disinfectant alone, and 60, 66, and 63 respectively for the three insecticides combined with "Arasan" SF. In these tests, where stand counts were used as a criteria for evaluating the results, the insecticidal effectiveness naturally would not be shown. This can be determined only by recording the condition of the plants, as was done in test 3, where seed corn maggots were serious.

Impossible to Predict Insect Attacks

In view of the average good results obtained when a fungicide alone was used, the California scientists point out that this does not mean that an insecticide also should not be used. "These results suggest," the report said, "that if soil insects are not a problem....it might be best to limit seed treatment to the use of a fungicide. However, it is often impossible to predict attacks of certain insects, particularly seed corn maggots, and since soil insects can and often do cause reductions or complete loss of stands, it seems that in many cases a combination treatment would give the most satisfactory protection."

While in the over-all picture the effect of insect attacks did not figure prominently, they did in one trial, (No. 3).

"In this instance," the authors said, "both seed decay and seed corn maggots were important factors affecting the stand of seedlings.....Lindane significantly reduced emergence but only when it was used alone. In combination with any of the fungicides this reduction did not occur. Counts made to reflect the number of seedlings badly damaged by seed corn maggots show a total of 507 maggot damaged seedlings in the plots not treated with lindane as compared to five seedlings in plots treated with lindane. This protection of seedlings against maggot damage is further reflected in the numbers of normal seedlings constituting the stands. Here, lindane significantly increases stands whenever it is added to a fungicide. Although it gives good protection against maggot damage when used alone, this protection was not enough to overcome the adverse effect on germination."

(continued on page 114)

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